Economy Index

Preamble: The Economy and Its Role in Acquiring Knowledge for Development

Classical economic theories suggest that productivity is dependent on a number of key factors including land, labour, organisation and capital. In recent times information technology and knowledge have been added to this list of factors owing to the changes witnessed in the global economy over the past three or more decades. Knowledge and information have gained particular prominence, changing our understanding of the foundations for economic growth, and countries have begun to actively pursue policies to promote the development of knowledge-based economies as a means to foster growth and development.

The relationship between knowledge and the economy stems from the understanding that knowledge can boost productivity and economic growth. It does so by facilitating the application of technology through all stages of the production and delivery chains.

In countries where transition to a knowledge economy has been possible, visible benefits have accrued in terms of increased gross domestic product (GDP), new job opportunities, innovation in the way business is conducted and improvements in the management of human and financial resources, thereby resulting in higher productivity. This has also led to transformations in finance and commerce, where businesses may now rely on digital resources in guiding domestic and international relationships and transactions leading to an increase in available capital and a sharp growth in profits.

The effective investment of knowledge to support economic development has become a primary concern for many societies, but there is a significant imbalance in their capacities in terms of levels of knowledge and technological advancement. As the digital gap widens between developing and developed countries, moving towards a knowledge economy has become an ever-present challenge for developing societies facing declining productivity and economic capabilities alongside persistent poverty, unemployment and other social and economic problems.[1]

Knowledge Economy: A Brief Historical Background and Overview of Definitions

The first and most prominent transformation in human civilisation began with the establishment of settled agriculture, originating in large river basins such as the Tigris and Euphrates. War was commonplace during these periods, largely due to attempts to gain control over such areas that allowed the emergence and development of state power, governance, regulation and law. The establishment of relatively large population groups led to the evolution of administrative and political organisations that reflected the level of societal development at the time. The second major transformation began with the Industrial Revolution, which originated in Britain and then expanded to mainland Europe and North America. Knowledge was characterised at that stage by its roots in application, i.e. application preceded theory.

The greatest transformation in the perception of knowledge began in the last quarter of the twentieth century, characterised by rapid, advanced scientific and technological progress leading to the information and communications technology (ICT) revolution. Information and knowledge now constituted essential economic resources, supplementing natural resources in economies that had taken the first steps in their evolution toward becoming "knowledge" or "knowledge-based" economies.

In short, after land and labour – the main resources for wealth generation in the pre-industrial era – capital and energy (labour) were overtaken by science and knowledge as the key production factors in modern day societies a period known as the post-industrial era. Knowledge production, investment, consumption (application) and circulation (or dissemination, sharing, integration) became primary sources for growth and consequently together comprised the main engine for development. Knowledge, together with new sources of capital, ideas, experience

and practices, was now immeasurably more important than physical capital in the new economy, and scientific–technological advancement transformed labour from being manual to knowledge-based, confirming technology and knowledge as the two main factors for achieving growth and sustainable development.[2]

Despite these historical trends, some confusion remains regarding the definition of what constitutes a "knowledge economy". References abound to the information economy, the Internet economy, the digital economy, the virtual economy, the electronic economy, the web economy and the intangible economy; in most cases, however, these terms are used interchangeably alongside "knowledge economy", reflecting the lack of consensus among researchers and theorists on a common and conclusive definition.

The Arab Knowledge Index has been prepared on the understanding that the knowledge economy describes advanced economies with increased dependency on knowledge, information and skills, and that there exists a consequent need for governments to facilitate access to these factors. As such, a knowledge economy is driven by the extensive use of information technology and the Internet in its various economic activities, culminating in a central role for technological development in the exchange of commodities and services.

Murad Illa summarises this phenomenon, providing an overview of the major definitions of the knowledge economy:

- The knowledge economy is an economic system in which qualitative and quantitative sciences represent the key element of production and the driving force for wealth production.

- In a knowledge economy, long-term production increases with the benefits of ICT.

- The Arab Strategic Report defines the knowledge economy as being imposed by new activities associated with knowledge and information technology, adding that

e-commerce represents the main feature of this economy.

- The knowledge economy is an advanced model based on the extensive use of information and communications technology in various economic activities, especially e-commerce, as well as being a product of knowledge, innovation and technological development.[3]

- The Organization for Economic Cooperation and Development (OECD) defines a knowledge economy as one based mainly on the production, dissemination and use of knowledge and information.[4]

- The United Nations Development Programme (UNDP) defines the knowledge economy as the efficient dissemination, production and utilisation of knowledge in all areas of societal and economic activity, civil society, politics and private life including the promotion of human development a phenomenon that necessitates the building and efficient distribution of human potential and capabilities.

- The knowledge economy is also considered to revolve around the access, participation, utilisation, implementation and innovation of knowledge for the purpose of improving quality of life in all areas through the enrichment of information via advanced technological applications and uses of the human mind. This information promotes strategic changes in the nature of the economy that bring about greater responsiveness and harmony with the challenges of globalisation, ICT, knowledge and sustainable development.

- The World Bank defines the knowledge economy as effectively applying knowledge to achieve economic and social development; this includes the transfer and utilisation of foreign knowledge, as well as the production, adaptation and localisation of knowledge to meet specific needs.[5]

Some literature defines a knowledge economy as one based on smart products such as computers that analyse and coordinate data and information in order to deal with real events in a similar way to human beings. Again, with information technology being the driving force, this type of economy requires sustainable investment to maintain the ability to respond effectively to the changing needs of the global economy.[6]

Similarly, Mohammed Diab summarised the knowledge economy as: "an economy where the production, dissemination and utilisation of knowledge constitute the main engine of a process of sustainable growth, wealth creation and job opportunities in all areas. It is an economy that is based on the production of knowledge (i.e. its creation) and using its fruits and accomplishments where this knowledge [in all its forms] constitutes a key resource for the wealth and well-being in the developed society".[7]

Against this background, the knowledge economy can be understood to fundamentally depend on information, means of exchanging information and data, and the role of knowledge in building capabilities and production factors in terms of land, labour, capital and organisation and fostering productive relationships between those factors in accordance with the latest technology and communications data. This constitutes a new revolution, subsequent to the Industrial Revolution, and represents a renewable branch of the economic sciences based on a new concept for the role of knowledge and human capital in developing the economy and advancing society. This is the economy in which knowledge achieves the greatest share of value added, based on ICT as its starting point.[8]

Distinguishing Between the "Knowledge Economy" and the "Knowledge-based Economy"

Some economists draw a distinction between the so-called "knowledge economy" and an economy based or built on knowledge. The acceleration of economic transformation and technological development has led some economic researchers to reconsider these two different interpretations of the term and make the following distinction between them:

The first interpretation: the knowledge economy relates to the knowledge of economic processes themselves, i.e. the production and formation of knowledge and the research and development processes, whether in terms of the cost of the knowledge process such as the cost of research and development or the cost of a business consultative administration or preparing and training the experts on one hand, and between the return or income resulting from this process, considered in the same way as the economics of tourism, hotel management or any other service, on the other hand.

The second interpretation: the term "knowledge-based economy" infers a wider and more extensive meaning in that it embodies the volume of knowledge, information and investment within the fabric of the economy as well as the extent of knowledge and technology penetration in production activities.

The knowledge-based economy is considered to be the advanced stage of a knowledge economy, i.e. it is dependent on the application of the knowledge economy in various economic and social activities, for example by linking information technology and other sectors such as communications (remote diagnosis of medical conditions, conducting remote surgical operations, remote production, remote conferences, etc.). This constitutes an economy built on knowledge and science. The major industrialised countries have benefited from the accomplishments of the scientific–technological revolution and have exploited them in industry. This in turn has resulted in new knowledge, new discoveries and advanced technology, enabling them to reach the stage of a knowledge-based economy, or what could be termed a "post-knowledge economy". Whereas the countries seeking to produce, acquire, spread, apply and store knowledge remain in the knowledge economy stage.

Source: Murad Illa 2013 (Reference in Arabic).

Table 1:

Characteristics of the Knowledge Economy in Comparison to the Traditional Economy[9]

Traditional Economy	Knowledge Economy
- Investment in material capital.	- Investment in knowledge capital.
- Reliance on physical effort (tangibles) fundamentally in traditional economy.	- Reliance on intellectual effort (intangibles) fundamental to the knowledge economy.
- Stability of markets in the shadow of completion governed by authoritarian bureaucracy.	- Dynamic market operating in the shadow of open competition.
- Mechanisation being the main engine for industrial economy.	- Digitisation being the main engine for knowledge economy.
- The traditional economy, aims to employ an entire workforce without defining specific skills for performing the work.	- The knowledge economy aims to establish real value for pay, expanding the use of highly skilled employees who interact thanks to continuous education and training.
- In a scarcity economy, resources are exhausted with continued use.	- In an abundance economy, resources (knowledge) increase with continued use.
- Agricultural economy subject to the law of diminishing returns (increased costs) and the industrial economy subject to the law of fixed returns (fixed costs) with continued use.	- A knowledge economy subject to the law of increased returns (diminishing costs) with continued use.
- Relationships between management and the workforce in a traditional economy are characterised with stability.	- Relationships between the management and workforce in a knowledge economy are characterised by instability, since the principle of lifetime employment has been abolished.
- Relationships between business sectors and the state are unbalanced, since the state imposes its control and issues its orders in accordance with the economic requirements and intentions of the state.	- Relationships between business sectors and the state in a knowledge economy are based on alliance and cooperation.
- Restricted by time and place.	- Unrestricted by time or place.

Table 1 illustrates the key characteristics distinguishing both a knowledge-based economy and a knowledge economy from a traditional economy. It is noteworthy that the fundamental determinants of the knowledge economy are in the use of knowledge, the dependency on mental efforts of knowledge and information, and the dynamics that determine competitive production through its control exclusively in the area of using and localising knowledge and improving production levels, and doing so by implementing the constituents of the knowledge, technological and communications revolution. In addition, there is extreme reliance on digital technology, the constituents of science and training and openness to others as well as transferring knowledge to the entire elements of production areas, especially those relating to the human element. The role of the knowledge economy is determined through knowledge and technological exchange between the private and public sectors, in addition to the importance of complete openness and communications with the outside world, devoid of tangible or intangible borders.

Source: Ali bin Hassan Yaen Allah al Qarni 2009; as sourced in Murad Illa 2013 (reference in Arabic).

Methodology for Selecting and Constructing Indicators

Attempts to select indicators expressing the elements of knowledge in an economy are not new, and numerous similar indicators are reported in the literature. These indicators will be illustrated below, before detailing those employed in this study.

Current Indicators: A Literature Review

Commonly used indicators of the knowledge economy today focus on the extent of countries' readiness to compete in the context of the knowledge economy, the concept of which has been discussed in the previous sections of this study. These indicators are based on four key areas, namely:

The System of Economic Incentives

The economic incentives system is considered to be an important mechanism for transferring, importing and attracting knowledge to the state. Any country that wishes to provide numerous avenues of competition within a knowledge economy requires an economic base that is built on strong foundations, enabling the country to provide all that is necessary in terms of political and legal frameworks that promote growth and productivity and produce more productive knowledge and knowledge growth. Such policies and procedures provide all the means necessary to make ICTs more affordable and accessible in the economy.

Innovation

Innovation depends on the levels of expenditure on research and development, and on the quality of some other sectors such as education and information technology. Countries with limited expenditure in these areas suffer from a lack of innovation leading to weakness in their knowledge economies. Consequently, most extensive austerity policies have led to reduced growth and progress. In order to maintain innovation in the economy, regulations must be introduced and their application enforced in all sectors, governorates and geographical areas.

Education and Training

Human resources contribute to the development and growth of economic activity, especially in the context of the knowledge economy and the advanced technology it employs. The indicators used for studying this dimension of the knowledge economy are very few, since there are only two main sources for human resource indicators. The first is education, training and skills assessment, and the second is the competence and professionalism of employees. These indicators allow for the assessment of assets and investment in human capital.

Information and Communications Technology

Information technology and its most advanced resources are considered to be of major importance in the world today, having expanded to all areas, specialisations and professions. Therefore the constituents of this area are also considered to be important indicators, and it is vital that a knowledge-based economy is provided with a suitable technological base which leads to intensified knowledge activities and the production and penetration of new technologies.

On the other hand, over time the following weaknesses have been demonstrated in previous indicators:
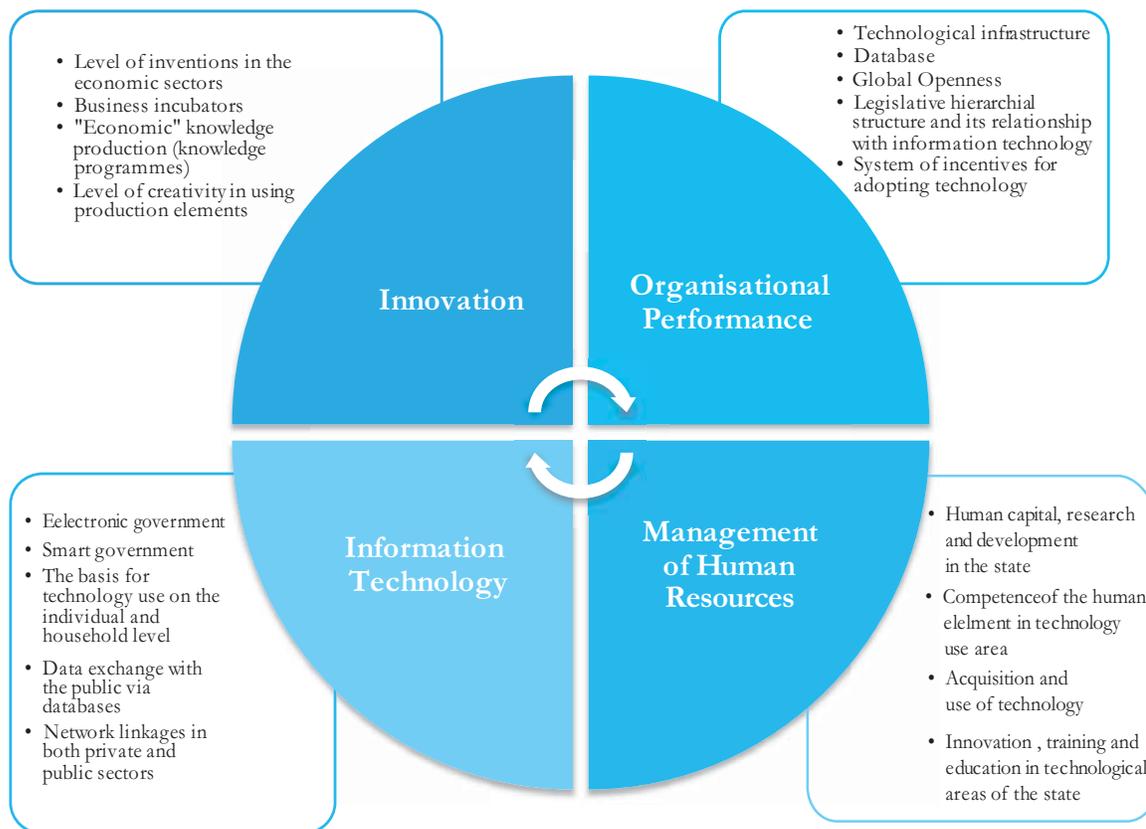
- Lack of clear constituents for indicators, and dependence on a descriptive format rather than a quantitative analytical format;

- Enhancement of some indicators by certain countries owing to non-scientific pressures prior to their disclosure;

- Excessive focus on the technological dimension rather than addressing dimensions relating to economic structure, resources and production elements;

- Seeking to establish description-based analyses instead of a digital index representing a digital condition, which may be used as the basis for improving the levels of knowledge in target areas within the economy;

- The absence of a comprehensive picture of the economic sector in the Arab countries in a form that is sufficient to assist in devising national policies for improving the level of knowledge in such areas as economic structure, human resources, innovation and creativity, and developing the role of information technology in the economic sector.

Within the context of the aforementioned points, this study suggests that a complete picture of the Economy Index should entail three interrelated themes, namely: the organisational performance of the economy, including its human resources; economic structure, including the role of creativity and innovation; and the role of ICT in the cohesion of an economic knowledge structure.

Hence, the most important factors in selecting and constructing indicators for the economic sector as part of the general Arab Knowledge Index involved these themes: i.e., the organisational performance of the economy; appropriate qualification, employment and management of human resources; the role of ICT in the economy; and creativity and cognitive development in the economy. Figure 1 details these themes, where the elements of organisational performance depend on the significance of the cognitive infrastructure of the economy and its associated legislation, as well as the degree of institutional openness within the economic structure of the state. The human resources factor depends on the appropriate employment, qualification and management of human capital in the economy. This leads to – or limits – the processes of research and development, human competence and the level of interest in qualification, training and capacity-building. The elements of the ICT factor relate to the technological base in the relevant economy, whereby they also represent the concept of technological capital in production - the

Figure 1:

The Main Axes for Elements of the Economy Index

- Level of inventions in the economic sectors
- Business incubators
- "Economic" knowledge production (knowledge programmes)
- Level of creativity in using production elements

- Technological infrastructure
- Database
- Global Openness
- Legislative hierarchial structure and its relationship with information technology
- System of incentives for adopting technology

Innovation

Organisational Performance

- Eelectronic government
- Smart government
- The basis for technology use on the individual and household level
- Data exchange with the public via databases
- Network linkages in both private and public sectors

Information Technology

Management of Human Resources

- Human capital, research and development in the state
- Competenceof the human elelment in technology use area
- Acquisition and use of technology
- Innovation , training and education in technological areas of the state

main mechanism for developing the type of production in the concerned economy. This applies to the public sector in the areas of e-government or "smart" government, on the basis of exchanging technological data with relevant entities such as individuals and institutions dealing with government. This also applies to the private sector and the level of development of its technologically productive base, including relationships with the relevant entities such as producers, consumers and government. Whereas the fundamental constituents of the axis of creativity and innovation rely on the level of research and development, new inventions and the extent of innovation in the productive processes require the use and implementation of the four elements of production.
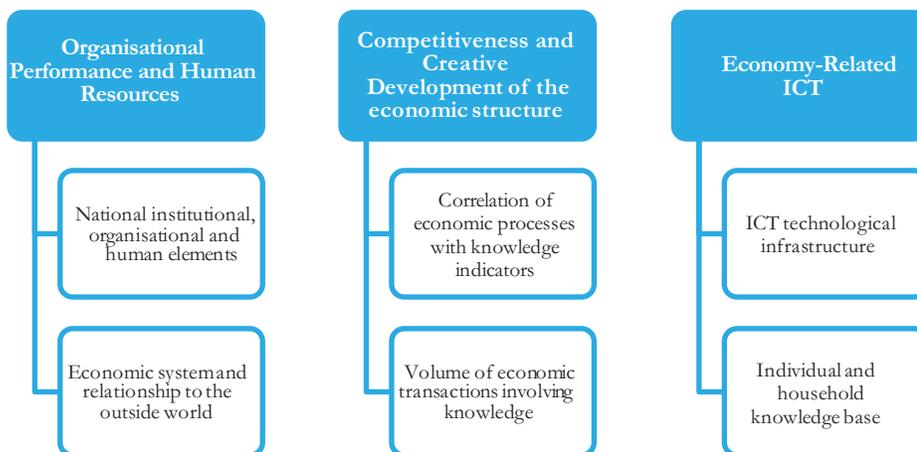
In discussing the AKI, it is noteworthy that some elements intersect within the various areas of the Index, since there are numerous indicators or elements that might be included in the field of education in all of its various stages which contribute directly or indirectly to the processes of using and employing the elements of production in any economy. Numerous indicators describe scientific research, innovation and development that contribute directly to determining the level of knowledge in the economy, the level of productive process development, and the practice of exploiting the elements of production. The same also applies to ICT

indicators that intersect horizontally and vertically with the four axes illustrated in Figure 1.

Within the scope of this framework it was agreed, after exhaustive consultations among the core team authoring the AKI, that the Economy Index should involve the elements illustrated in Figure 2, where the sub-indicators fall within three main determinants: the organisational performance and human resources; competitiveness and creative development of the economic structure; and ICT in relation to the state's economy. Figure 1 illustrates the main areas selected under each of these economic indicators.

The methodological elements were produced via a comprehensive review of the economic literature in areas of the knowledge economy and competitiveness, drawing on available statistical data. The constituents of the aforementioned areas were constructed within a multi-party consultative framework involving each of the members of the core team of the Index and the experts in the fields of economics and ICT. A specialist workshop was also held for one full day with experts from Jordan, Egypt, Lebanon, the United Arab Emirates and Tunisia to determine what progress had been made and what had been agreed upon regarding the indicators and their relative weights.[10] In this context, everyone agreed that the constituents

Figure 2:

Pillars of the Economy Index and Its Components in the Arab Knowledge Index

Organisational Performance and Human Resources	Competitiveness and Creative Development of the economic structure	Economy-Related ICT
National institutional, organisational and human elements	Correlation of economic processes with knowledge indicators	ICT technological infrastructure
Economic system and relationship to the outside world	Volume of economic transactions involving knowledge	Individual and household knowledge base

of the organisational performance structure and human resources provided the most extensive foundation for constructing a knowledge economy index. Accordingly, these constituents were given the relative weighting of 50 per cent of the Index, while it was agreed that the constituents of the competitiveness and creative development economic structure should be given a relative weight of 30 per cent. The remaining weight – 20 per cent – consisted of economy-related ICTs. A relative sub-weight was adopted that is equal to all the indicators within the three aforementioned areas due to the futility of assigning disproportionate weights to the sub-indicators at this stage of the report. This would prevent the issue being subject to personal opinion and personal judgment concerning these sub-constituents.

Presenting the Proposed Economy Indicators

In keeping with the methodology outlined above and the divisions agreed for the three areas relating to the economy indicator in the AKI, the following are the proposed indicators for the sector and their domestic and international sources. These are: organisational performance and human resources; creative development and economic structure; and ICT in relation to the national economy, as shown in Table A5of the Annex. In the table, the indicators are divided into three key areas, namely: indicators of organisational performance and human resources, indicators of competitiveness and creative development of the economic structure, and indicators of ICT in relation to the economy. Weights were allocated based on the literature reviews, expert consultations and wide-ranging discussions in the workshop held in Amman in mid-September 2015. The consensual weights for the three key areas were 50, 30 and 20 per cent, respectively. It was also agreed to divide the aforementioned three areas into sub-levels so as to facilitate access to a qualitative accumulative indicator in each area. In this context, the areas of organisational performance indicators and

human resources contained four sub-levels: openness to the outside world, indicators at a sub-weight of 40 percent of the total weight of organisational performance and human resource indicators; institutional organisation of economic indicators at a sub-weight of 20 per cent; institutional empowerment of the economy indicators at a sub-weight of 20 per cent; and human resources indicators also at a sub-weight of 20 per cent. Competitiveness and creative development of the economic structure were broken down into two sub-levels: the competitiveness of economic structure indicators at a sub-weight of 67 per cent; and development of economic structure indicators at a sub-weight of 33 per cent. Economy-related ICT was also divided into two sub-levels: technological knowledge exchange in the economy indicators at a sub-weight of 50 per cent; and enabling environment of the economy indicators at a sub-weight of 50 per cent. Table A5 of the Annex fully illustrates the constituents and sub-constituents of each area.

The main indicators and sub-indicators are listed in the table, which summarises the various opinions of the experts and the literature reviews conducted by the research team and the core team. The absence of certain data and the outdated nature of others made it impossible to retain all the sub-indicators in their original form. Consequently, the indicators that were adopted are summarised in Table A5 of the Annex. The table explains the key indicators in the three areas, as well as the sub-indicators in each area and their sources and references. There are 14 sub-indicators in the organisational performance and human resources indicator, which in turn corresponds to 50 per cent of the relative weight of the economy sector indicator. Meanwhile, there are 11 sub-indicators to the creative development of the economic structure indicator, which represents 30 per cent of the relative weight of the economy sector indicator. Finally, the constituents of the economy-related ICT indicator, representing 20 per cent of the relative weight of the economy sector, includes 8 sub-indicators.

The following section provides detailed explanations of these indicators.

Organisational Structure and Human Resources Indicators (50 per cent of total Economy Index weight)

These indicators include constituents related to national organisational and human elements, and those related to the economic system and its relation to the outside world. The following provides definitions and explanations for the most important sub-indicators comprising this indicator:[11]

Economic Openness

This indicator is measured by the ratio of total exports and imports of a country to its GDP, where it is assumed that those seeking to achieve knowledge economies move towards increasing trade openness that is based, in turn, on attracting investments to maximise their accomplishments, increase competitiveness and keep pace with the latest developments in the market. It is an indicator that reflects the degree of openness to the outside world in terms of imports and exports, and their associated knowledge flows.

Fixed Gross Capital Formation as a Percentage of GDP

The fixed gross capital formation for any country is derived from expenditure on capital goods such as machinery and equipment, in addition to change in stock. The concept of fixed capital formation as a percentage of GDP is fundamental to determining the capability and competence of investment policy because it links two important variables – capital or capital formation and what this includes in terms of capital goods, and GDP – in addition to other important factors in determining the level of economic growth. However, the capital formation (capital) factor is unique in measuring the level of economic growth for a given country. This indicator is an important factor in the knowledge economy; whenever the percentage increases, the value of the investment increases, meaning that there is an increase and improvement in the technological advances being absorbed by the economy.

Tariff and Non-Tariff Barriers

Easing tariff and non-tariff barriers, especially on technological products, serves to enhance the prosperity of small and medium-sized enterprises (SMEs) with respect to their progress, growth and competiveness. In addition, this indicator provides a measure of the streamlining of goods and services, including goods that transfer high levels of knowledge.

Soundness of Banks

This is a statistical scale including numerous financial and monetary indicators for measuring the viability and efficiency of the banking system. The knowledge economy is dependent upon efficiency levels in the banking system in the country in question; whenever the system is efficient and effective there is an improvement in the environment necessary for the maturity and development of the knowledge economy. It focuses on the banking sector because this constitutes about 90 per cent of the total financial sector in most Arab countries.

Domestic Credit Allocated to the Private Sector as a Percentage of GDP

This credit consists of all of the finance and facilities allocated to the private sector, divided by the GDP of the state in question. The increase in the percentage of credit allocated to the private sector from GDP is considered to be a good indicator of a similar increase in growth rates. That is because an increase in the credit allocated to the private sector reflects significant progress in increasing the volume of investment and consequently the need for greater knowledge transfer and expansion of the services provided by the private sector.

Rule of Law

The rule of law and its just enforcement is considered to be a significant factor in boosting the strength of the economy in general, and more specifically supports freedom and competitiveness. Conversely, fear of restrictions and lack of transparency both impose a challenge to growth,

investment and knowledge expansion. Rule of law plays a major role in determining levels of confidence and safety which contribute to the sustainability of growth and development.

Government Effectiveness and Regulatory Quality

Many countries attempt to establish sound and effective foundations to drive growth and development in a knowledge economy, especially in the area of attracting foreign investment. These are very much affected by the standard of governance of official institutions and their regulatory quality, and by facilitating the process of attracting investment inflows to the country.

Political Stability

The first and most important factor determining the flow of any foreign investment is the political stability of the destination country, especially in the case of investment in high-tech industries, which are characterised by their high costs. The issue of political stability constitutes the most prominent concern when considering the transfer of such investments and the advanced information and knowledge that accompany them.

Research and Development Personnel

These are the experts who seek to innovate and produce new knowledge, products, tools, processes, methodologies and/or systems. They work in the areas of project management and patents, where research is subjected to data collection processes in a systematic and standardised manner, facilitating dynamic analyses and international comparison.

Competitiveness and Creative Development of the Economic Structure Indicators (30 per cent of total Economy Index weight)

These indicators include constituents linked to the relevant economic processes that affect the increased flow, transfer and production of knowledge, and processes relating to the size of knowledge–economic transactions. The following is an explanation of the most important sub-indicators in this area.

Number of Procedures Required to Start a Business

This is the number of procedures required to obtain a licence from the official authorities to establish a given business. It is assumed that countries that facilitate the procedure for establishing a project, registering it and executing its contracts, especially for foreign businesses, are advanced in terms their willingness to attract investment. As the benefits and incentives granted to registering an establishment increase, there will be more facilities and incentives to increase the penetration of associated technology and knowledge into the local economy.

Number of Days Required to Start a Business and Enforce a Contract

In addition to the importance of the costs of registering a project, and the number of necessary procedures to undergo when implementing it, the number of days necessary for executing and enforcing a contract in the state is equally important for any local or foreign investor. When the procedures are affordable and fast, investors' interest in projects in the country increases. This is particularly true of foreign investments, which also bring technological expertise and progress.

Inflows of Foreign Direct Investment (FDI)

Foreign investment describes international funds flowing into the local economy, which are normally calculated as a percentage of GDP. Foreign direct investment (FDI) is considered one of the most important indicators reflecting the flow of technological progress and its incorporation into the domestic economy, increasing the level of knowledge in the country and expanding the foundations for a knowledge-based economy. FDI inflows embody the basis of globalisation, through which numerous gains and benefits accrue to host countries that contribute in enabling and developing the knowledge economy.

Rate of Value Added of Manufacturing to GDP

This rate reflects the degree of technological progress achieved in goods manufacturing in the country; consequently, this indicator implicitly includes the degree of access to technology and knowledge by and from the country. As such, it is closely linked to measuring the degree of an economy's dependence on knowledge in its trade processes. It is an indicator that reflects also the extent of the development of the economy in manufacturing, its ability to compete in the market, and the extent of its ability to keep pace with the latest developments in international markets.

Tax Rate as a Percentage of Profits

This indicator measures the presence of tax incentives. High tax rates as a percentage of profits represent an obstacle to attracting knowledge and non-knowledge related investments; i.e. high tax rates are inhibitors of knowledge or knowledge-based economies.

Intensity of Local Competition

The level of local competition is considered among the most important determinants of knowledge transfer and investment, and an integral part of the qualitative indicators determining increases in knowledge and expenditure on research and development. It is presumed that as competition increases, the need for research and development increases for the purpose of infiltrating the market and acquiring better and larger market shares.

Economy-Related ICT Indicators (20 per cent of total Economy Index weight)

These indicators fall within the essential communicative relationship between the knowledge economy and the ICT sector. These indicators include constituents related to technological infrastructure and the ICT sector as a highly influential component that is both horizontally and vertically integrated in the economy. These constituents relate to the cognitive dimension at the individual and household levels in the economy. The following is an explanation of the most important sub-indicators in this area and their definition, while it reserves those aspects that relate to the information technology sector for the designated chapter of the Arab Knowledge Index.

High-Tech Imports and Exports

These two indicators are considered among the most important in relation an economy's global interaction in the areas of advanced technology and knowledge exchange. In accordance with international data, the advanced technology exports indicator and the advanced technology imports indicator are both available for most countries. Development in the trade of high technology exports and imports is considered a key element of a national economy and a genuine indicator of knowledge exchange and development, and even of knowledge localisation.
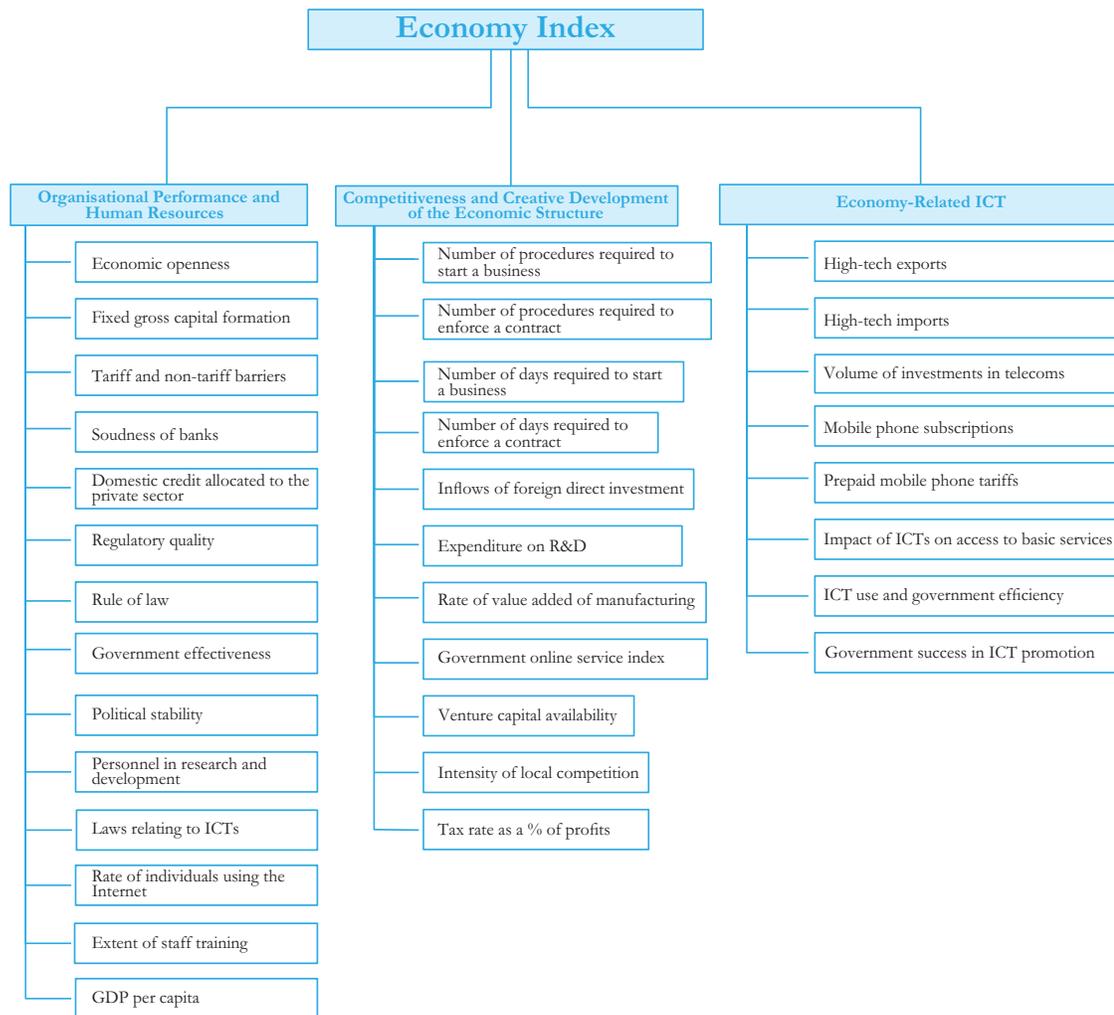
Volume of Investments in Telecoms

Increases in investment in the telecommunication sector are considered a valuable indicator of the potential for accumulating economic knowledge in facilitating commercial and governmental transactions; consequently, it is an important means for increasing the productivity of countries' production elements.

Prepaid Mobile Phone Tariffs

The cost of using technology is a fundamental determinant in increasing productivity and in the exchange of goods and services in a given country. Therefore higher mobile telephony costs, for example, are considered to be a hindrance to promoting the utility of smart government [e-government] applications among consumers. Subsequently, the cost of using technology, expressed here in prepaid mobile phone tariffs, is an important indicator of the level of knowledge in the economy in terms of production, consumption and exchange.

Finally, it is possible to characterise the constituents of the previous indicators, in

Mapping the Economy Index

Economy Index

Organisational Performance and Human Resources

- Economic openness
- Fixed gross capital formation
- Tariff and non-tariff barriers
- Soudness of banks
- Domestic credit allocated to the private sector
- Regulatory quality
- Rule of law
- Government effectiveness
- Political stability
- Personnel in research and development
- Laws relating to ICTs
- Rate of individuals using the Internet
- Extent of staff training
- GDP per capita

Competitiveness and Creative Development of the Economic Structure

- Number of procedures required to start a business
- Number of procedures required to enforce a contract
- Number of days required to start a business
- Number of days required to enforce a contract
- Inflows of foreign direct investment
- Expenditure on R&D
- Rate of value added of manufacturing
- Government online service index
- Venture capital availability
- Intensity of local competition
- Tax rate as a % of profits

Economy-Related ICT

- High-tech exports
- High-tech imports
- Volume of investments in telecoms
- Mobile phone subscriptions
- Prepaid mobile phone tariffs
- Impact of ICTs on access to basic services
- ICT use and government efficiency
- Government success in ICT promotion

accordance with the various discussions about the indicators and their role, in the form of an economic indicators chart, as illustrated in the figure below.

Main Challenges in Measuring Knowledge Economy Indicators

Accelerating economic growth is of growing significance to the knowledge economy. However, there are a number of difficulties that may hinder the role of knowledge in this regard, and which therefore frustrate attempts to establish accurate economic indicators. There are numerous difficulties in constructing an index in terms of data availability and accuracy, and further difficulties relating to the methodology of index calculation. The most significant obstacles in constructing an index for the economy include:

- Information affected by political dimensions and relationships between countries;
- 'Beautification' of indicators by some countries before disclosure;
- Potential non-availability of certain

indicators for some countries in the index.

- Disproportionate capabilities between countries, periodically leading to difficulties in the comparison process;
- The issue of intellectual property protection, which may prevent the disclosure of some indicators, especially those relating to research and technology.

Conclusion

The sub-component of the Arab Knowledge Index on economy comprises three main categories of indicator:

- Institutional organisational performance and human resources indicators;
- Competitiveness and creative development of economic structure indicators;
- Economy-related ICT indicators.

Weights were calculated based on literature reviews and consultations held via series of expert-level workshops that were convened to discuss the indicators. Consensus was reached on the weights of the three key areas (50, 30 and 20 per cent respectively). In terms of obtaining qualitative statistical results for the Index, it was agreed that the aforementioned three areas should contain sub-levels to facilitate the establishment of qualitative indicators in each area. The results presented by the main and sub-indicators in the specific section for each country were consistent with the relative distribution of the weights; also, the results were found to be in harmony with the available data for each country. Perhaps the main dilemma in the formation of a general understanding of the knowledge indicator in the economy stemmed from the availability of data for countries of the region on the one hand, and the years for which data was available for all countries on the other.

The Economy Index within the AKI provides additional detail through its sub-indicators. These sub-components include measures of the organisational performance of the economy and the role of human resources, economy competitiveness and the development of its creative structure, and indicators relating to the role of ICT in

supporting and enhancing knowledge in the economic realm in the countries included. The significance of these divisions and sub-divisions lies in their utility to policy-makers and other interested parties as identifiers of the strengths and weak points in each area that have an impact on knowledge in the national economy. Hence they may assist in strengthening and enhancing the areas in which the indicators are positive, and identify those indicators or areas that represent weak points in developing the knowledge economy itself or knowledge in the economy. They may also assist experts and policymakers in focusing their attention on areas that achieve real economic growth, using knowledge as a pivot point and developing infrastructure and human resources in the economy as well as developing and improving the economic environment in the areas of regulations, laws and directives.

To assess consistency in selecting the variables utilised in building the sub-indicators the Cronbach's alpha value was calculated, as well as a percentage interpretation drawn from the results of the variable analysis. Moreover, the results of the variable analysis were used in estimating the statistical weights for each individual variable in order to establish the sub-indicator and consequently the general economy indicator as a whole. In general, the results indicate a high value in the majority of the Cronbach's alpha results (higher than 0.7%) and a high percentage value (higher than 0.5%), indicating consistency in the selected variables.[12]

Finally, despite the initiative in presenting a new structural distribution for knowledge indicators in the economy through the approach detailed above – which differs from that commonly employed in the literature for calculating knowledge in the economy or in the knowledge economy – there are many areas that may inform the further development of this indicator in future stages of its calculation:

- Knowledge depends fundamentally on the development of the capabilities of the human element. It therefore may become beneficial in the future to develop indicators specific to human resources,

contrary to what has been listed in the relevant sub-area. Examples of this include but are not limited to sub-indicators relating to the level of digital illiteracy in the economy, the level of individual communication by smart devices, and the level of communications use in completing transactions at the individual level.

- If the subject of the index remains the objective of Arab knowledge, it will be in the future to calculate institutional organisational indicators relating to the Arab countries, including: Arab–Arab intra-trade openness; combined Arab investment indicators; levels of tariff and non-tariff taxation between Arab countries; and levels of Arab knowledge exchange.

- In the area of regional economic structure development, a requirement at the Arab level could be the development and indication of value-added in intra-Arab industries and technological exchange, as well as the level of intra-technological exports between the countries of the region.

The fundamental determinants for creating an Arab Knowledge Index continue to revolve around the availability of data and the level of confidence placed therein. It is also beneficial, within the context of developing a knowledge economy constituent at the Arab regional level to continue to determine both the degree of success and optimum applications at the regional level in order to serve as an incentive for other countries to adopt elements of Arab success. This may be most appropriate for countries falling within the same sphere of cultural or social heritage. The development of an AKI covering the economies of the region should also assist in developing levels of knowledge and both local and regional research and development, constituting much more than merely an area study used for listing the position of countries in the main or sub-indicators - an outcome that the results of this report seek fundamentally to achieve.

Endnotes

1. This section is largely based on the background papers submitted for this project by Dr. Ghazi Al-Asaf and Dr. Ahmed Al-Shaqran: Ghazi Al-Asaf 2015 (background paper); and Ahmed Al-Shaqran 2015 (background paper).
2. Mohamed Diab 2009 (reference in Arabic).
3. Issa Khleifi & Kamal Mansoury 2005 (reference in Arabic).
4. Abdul Rahman Al-Hashimi and Faiza Azawi 2007 (reference in Arabic), as sourced by Murad Illa 2013 (reference in Arabic).
5. Murad Illa 2013 (reference in Arabic).
6. Murad Illa 2013 (reference in Arabic).
7. Mohammed Diab 2009 (reference in Arabic).
8. Murad Illa 2013 (reference in Arabic).
9. Murad Illa 2013 (reference in Arabic).
10. The workshop on the economic indicator of the AKI was held in Amman, Jordan, on September 15, 2015 and attended by 15 experts from Jordan, Egypt and Tunisia. Additionally, consultations around the outcomes were held with external experts from the United Arab Emirates and Lebanon.
11. Some of the indicators mentioned in the constituents of this and other indicators were obtained from areas including information technology, innovation and creativity. Accordingly, the definitions of these indicators were left as depicted in these areas without repeating them in this chapter.
12. Refer to the "Statistical Methodology".